

Endovascular Treatment of Giant P1/P2 Aneurysm by Direct Puncture of the Vertebral Artery

Case Report

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Summary

Vascular access is usually achieved through a femoral arterial puncture using a modified Seldinger technique. However, selective catheterization of the great cerebral vessels by femoral approach fails completely when the vessel is tortuous or atheromatous. In case of posterior vascular circulation aneurysms, transbrachial approach or direct puncture of the vertebral artery (VA) is an alternative.

The aneurysms of the posterior cerebral artery (PCA) are reported to be rare. Due to unfavorable anatomic location, the PCA aneurysms are difficult to reach during surgical procedure. Endovascular embolization is at present considered to be more effective and safer treatment of the PCA aneurysms arising from different segments, offering a viable alternative to the surgical approach. We report the case of the giant left PCA aneurysm, located at the junction of P1/P2 segments, successfully treated by parent artery occlusion achieved after the direct puncture of the right VA which was used because both VAs were tortuous, irregular and their ostia were not accessible by femoral approach.

According to different authors, parent artery occlusion appears to be safe in the treatment of

P2 segment aneurysms, whatever the location of the occlusion. In our case we decided to perform this kind of treatment believing it was the only possible one.

Introduction

At present, catheterization of the VA is the main route of access for endovascular treatment of the posterior circulation aneurysm. In rare cases, when VA cannot be reached by the femoral approach, the vascular access by direct puncture is considered with the use of the technique described by Lindgren in 1950¹.

The aneurysms of the posterior cerebral artery (PCA) are reported to be rare, accounting less than 1% of all intracranial aneurysm, with the incidence of rupture to be 50%, the same as intracranial aneurysms in any other location^{2,3}.

Due to unfavorable anatomic location, the PCA aneurysms are difficult to reach during surgical procedure which results in high morbidity/mortality rates. Additionally, the surgical access to the PCA is considered technically challenging owing to the complexity of its perforating branches and their intimate relationship with the cranial nerves and upper brain stem². That is why endovascular embolization is



Figure 1

at present considered to be more effective and safer treatment of the PCA aneurysms arising from different segments, offering a viable alternative to the surgical approach⁴.

We report the case of giant left PCA aneurysm, located at the junction of P1/P2 segments, successfully treated by parent artery occlusion achieved after direct puncture of the right VA. Both VAs were tortuous, irregular and their ostia were not accessible by femoral approach.

Case Report

In July 2001, a 64-year-old woman was admitted to the neurological department because of headaches, increasing motor weakness of the right extremities and left CN III palsy. The CT images showed a large, round, well-enhancing after contrast structure, located on the left side of the brain stem, described as giant aneurysm.

Four months later she was readmitted to the neurosurgical department due to an increase of the weakness of the right extremities without sensory deficit. She also presented with mild sleepiness and decreased memory which resulted from the compression of the brain stem and hippocampus. A cerebral angiogram confirmed the presence of a giant aneurysm of the P1/P2 segment of the left PCA and showed no filling of the distal portion of the left PCA, beyond the aneurysm. Due to large size and wide, undefined neck - the aneurysm was regarded to be unsuitable for surgical clipping. Few days later an attempt to coil the aneurysm was undertaken and failed due to impassable tortuosity of both vertebral arteries at their ostia. PCom arteries were not filling in angiography, indicating that an access from anterior vascular circulation was not possible.

Two days after the first attempt, due to progression of the clinical symptoms the decision was made to use an alternative access to the aneurysm by the direct puncture of the right vertebral artery at the C3/C4 level.

Under general anesthesia, the right vertebral artery was punctured under fluoroscopy with 15 cm long, 19 G catheter needle. After the puncture, the sheath of the needle was then stabilized and used as a guiding catheter for microcatheter. The patient received our normal heparin regime for aneurysm embolization (5000-IU bolus, 3000-IU per hour). After thor-

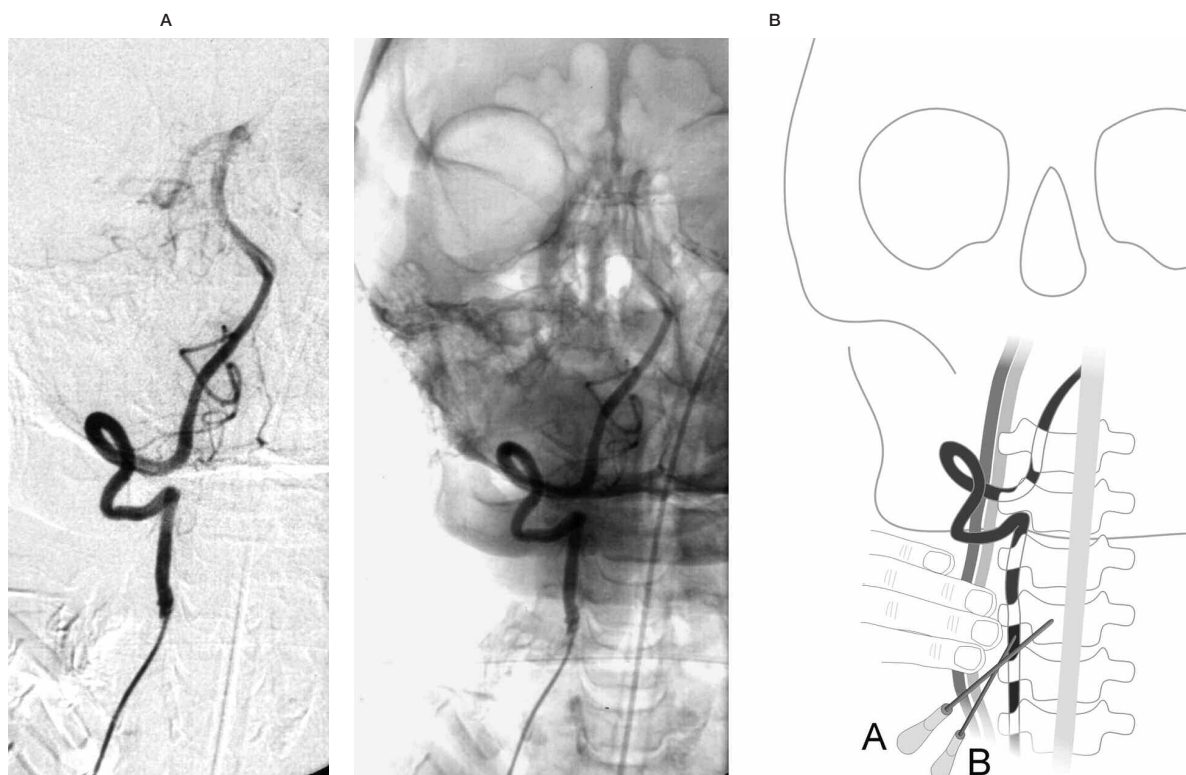


Figure 2

ough analysis of the angiogram, considering the fact that the distal segments of the left PCA and any of their branches were not filling, either due to the mechanical compression by the aneurysmal sac or by the "steal" phenomenon, we came to the conclusion that the parent artery occlusion in the proximity of the neck of the aneurysm would be an effective treatment. The microcatheter (Magic 1,8 F – Balt, Montmorency, France) over the guidewire (Transend 10 - Target Therapeutics, Freemont, Calif.) was then introduced and placed proximal to the neck of the aneurysm. Next 0,5 ml. of 50% Histoacryl/Lipiodol mixture was carefully injected resulting in complete occlusion of the distal part of P1 segment of the left PCA.

Final control angiograms of both ICAs and VA obtained immediately after treatment showed obliteration of left PCA, the aneurysm sac was not showing and the retrograde filling of the distal PCA by leptomeningeal anastomoses could be observed.

Before retrieving the sheath from the vertebral artery heparin was reversed with protamine. After 3 hours we started subcutaneous low-molecular heparine (Fraxiparine 0,3 ml. X2,

Sanofi Winthrop, Gentilly, France), and continued for 10 days.

Immediately after the procedure the patient was conscious, oriented, with a mild right-sided hemiparesis at the same level as before embolization. Six hours later, the patient became confused, hemiparesis increased. MRI scan was normal, did not show any ischemic foci. Neurological deficit resolved after 2,5 months time.

Discussion

Vascular access is usually achieved through a femoral arterial puncture with the use a modified Seldinger technique. Selective catheterization of the great cerebral vessels by femoral approach fails completely because of extensive tortuosity or presence of atheromatous changes. In such condition, vascular access to the particular artery must be achieved otherwise. In case of posterior vascular circulation aneurysms transbrachial approach or a direct puncture of the vertebral artery should be used⁵. Indeed, the latter is used rarely, for it is considered to be technically demanding and carrying considerable risks.



Figure 3

Percutaneous angiography of the vertebral artery was described in 1950 by Lindgren¹. The examiner presses two fingers of the left hand in between the brachiocephalic vessels and the aerodigestive lumen, at the level of C4. A catheter needle is then introduced toward the midline until it touches the vertebral body. The catheter needle is then directed upward and outward until it glides between adjacent transverse processes to hit the vertebral artery.

In 1953 Sjögren described a study of 200 direct vertebral artery punctures and reported only one complication - an infarct of posterior cerebellar artery⁶.

In 1998 Weill et Al. reported two cases of successful coiling of the basilar tip aneurysms by direct puncture of the vertebral artery. No peri-procedural complications occurred. They used the technique previously described by Lindgren and Sjögren but they did not use fluoroscopy during the procedure⁷.

We assumed, that in our case of a lady aged 64, obese, whose neck was short, with degenerative changes in cervical vertebrae what made intravertebral foramina quite narrow, it would be safer and easier to puncture the artery under fluoroscopic control.

Matsubara et Al. reported 5 patients with a ruptured basilar tip aneurysm treated by coiling. In 1 patient the vascular access was gained by direct puncture of the vertebral artery. The right transbrachial approach was also chosen in one patient⁸.

It must be remembered that vertebral artery cannot be compressed at the level of the neck, so small-caliber catheter needles should be used (we used 19G needle) and heparin reversed before withdrawing the catheter. We thoroughly followed this protocol.

At present, we can avoid unnecessary risks that may occur during direct puncture of vertebral artery. Prior to the procedure, it may be vi-

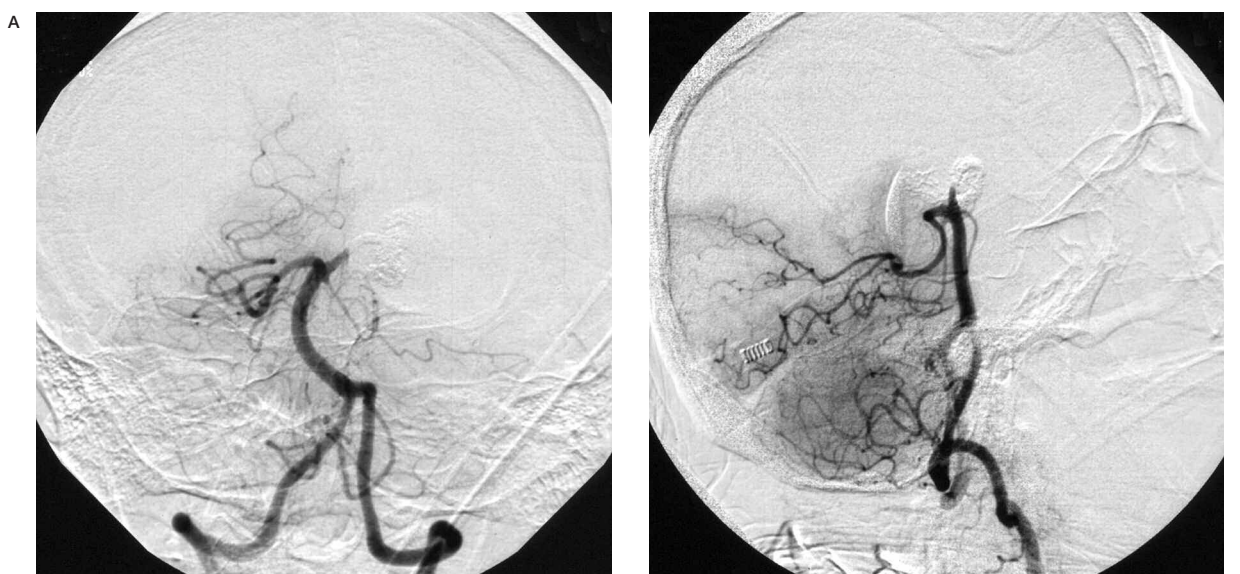


Figure 4

sualized and examined by MR-angio or CT-angio. So, it may be assumed that when performed carefully, the real risks of this procedure are limited, although today the direct punctures of the vertebral artery are rarely performed.

Aneurysms arising from the PCA have a predilection for the P1 and P2 segments³. These aneurysms have some peculiar morphologic features and present with specific clinical findings like seizures or neurologic deficit which are the result of mass effect on the surrounding brain parenchyma⁹.

P2 segment aneurysms may be difficult to reach during surgical procedures. The potential for morbidity and mortality is considerable with surgery, because the perforating branches are closely related to the cerebral peduncle. In addition, resection of the overlying parahippocampal gyrus is sometimes necessary². In the surgical series of Terasaka et Al., four of 14 patients had a disability after surgery¹⁰. Compared with surgical clip placement, endovascular treatment has notable advantages in treatment of P2 segment aneurysms because it is not associated with manipulation of the surrounding tissues. Therefore, the risks of brain infarction due to retraction or removal are theoretically reduced.

At present, it has been widely accepted that the treatment of choice of berry aneurysms of the PCA is selective endovascular obliteration with GDC, with preservation of the parent artery and the antegrade flow. The endovascular obliteration of small aneurysms with a small neck with GDC has been reported to be safe and effective with good long-term follow-up³. However, in case of fusiform, serpentine or giant aneurysms parent artery occlusion becomes often inevitable in order to achieve complete obliteration.

In the series of 10, P2 segment aneurysms treated by endovascular, simultaneous occlusion of aneurysmal sac and parent artery, Hallaq et Al. reported no complication in treated patients immediately and 1 year after the procedure². In large and giant fusiform serpentine aneurysms and true fusiform aneurysms, the authors advocate the use of the combined occlusion of the sac and parent vessel with coils and glue, which may be difficult, especially in wide-necked aneurysms. In giant aneurysms, this combination is supposed to ensure a reduction of the mass effect caused by the aneurysm,

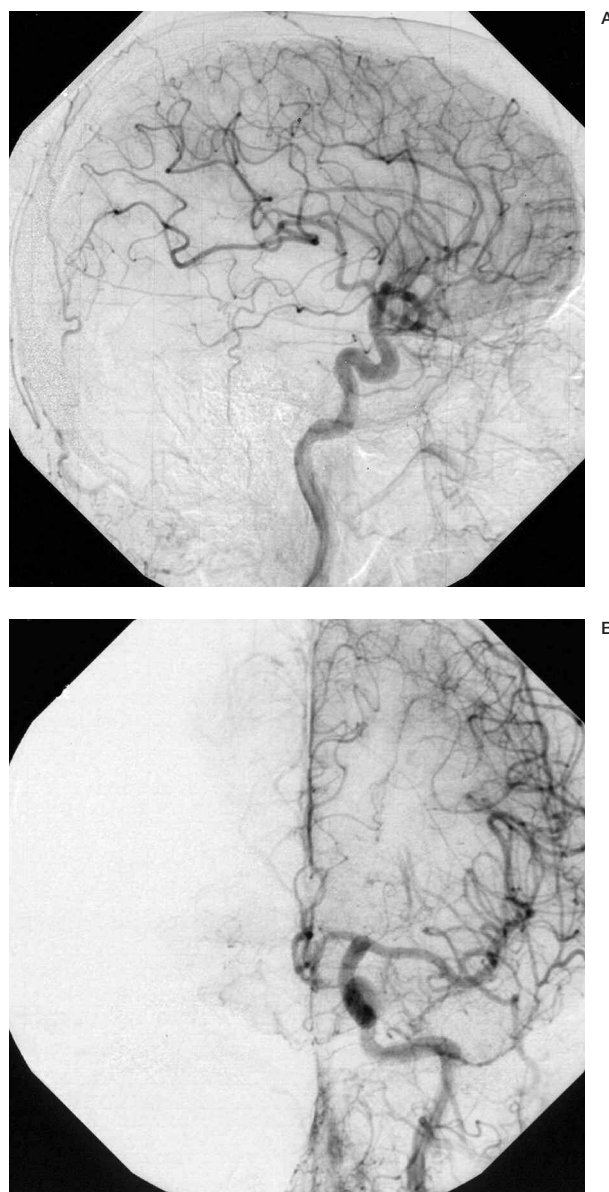


Figure 5

as others report¹¹. Thorough anatomic knowledge of the various segments of the PCA and their functional territories becomes crucial in order to predict and to avoid the neurologic deficit that may occur as a result of their purposeful occlusion^{2,3}.

In our case, there was a dilemma about the best treatment of the giant, P1/P2 junction aneurysm, which should have been used. As we noticed, after careful analysis of the angiogram, there was lack of filling of the distal portion of the left PCA, which we considered a favorable

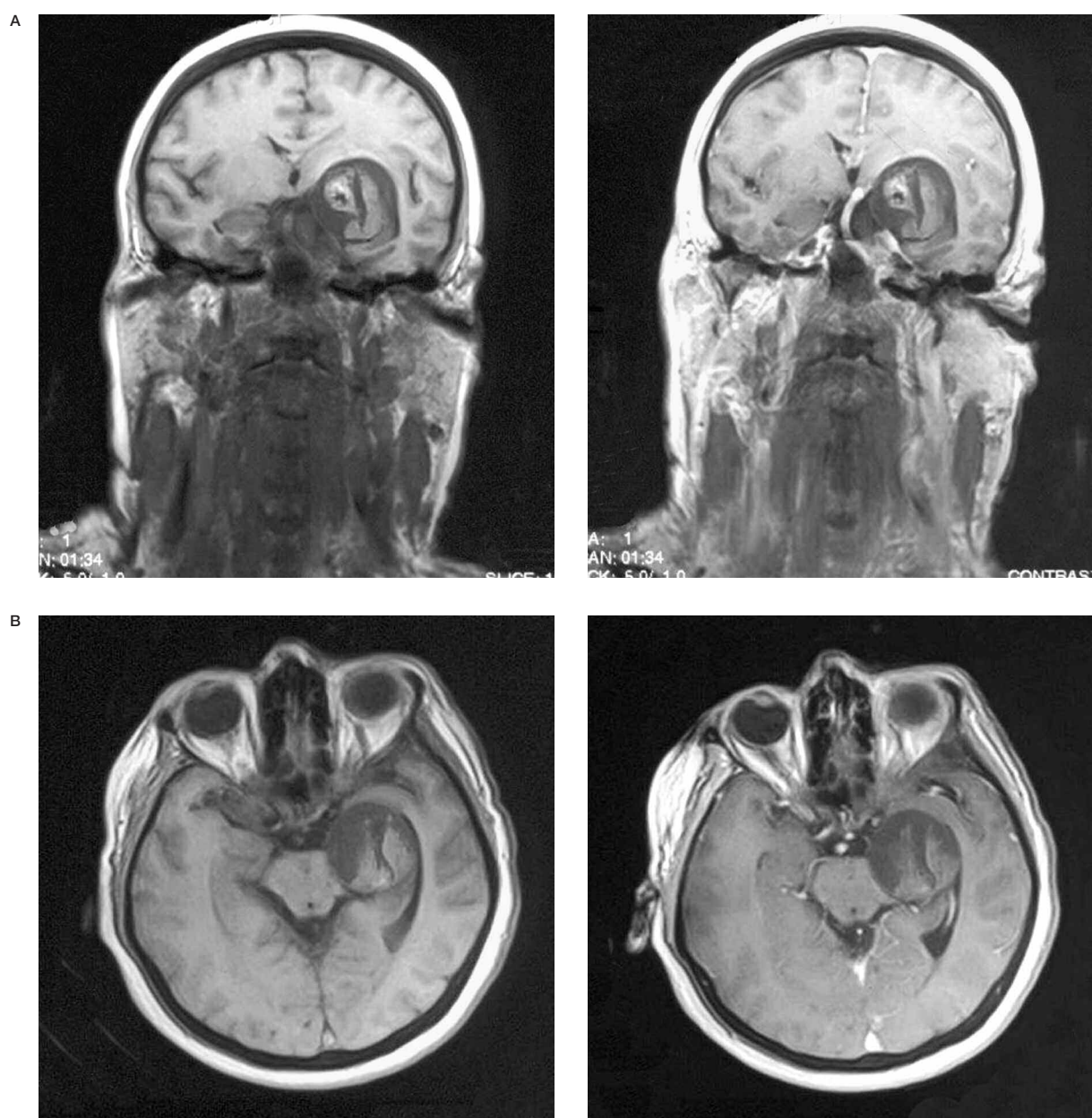


Figure 6

condition for parent artery occlusion. On the other hand, the occlusion of the PCA at the level of P1 or P2 segments is considered to be risky for they give rich vascular supply to the brain stem, thalamus and internal capsule. That is why, our idea was to “plug” the distal part of the P1 segment at the shortest possible length in order to avoid closing of the perforating branches which surely were there although invisible.

We decided to use high-concentrated glue which, in our opinion, permitted stable and controllable occlusion. An economic factor - coiling of this aneurysm would have taken many coils, with no certainty to obtain the complete occlusion of the sac, played role in our decision-making.

The use of glue injection for aneurysmal sac together with parent artery occlusion in the treatment of P2 segment aneurysms was re-

ported by Hallaq et al. with good result². In each case, occlusion took place at the level of the neck or right before it. We applied same strategy in our case. The procedure ended with technical success but the post-operative patients condition, showed that apparently one the capsular perforators must have been occluded or temporarily obstructed.

We believe that our case demonstrates the technical and strategical challenges a neurointerventionist may face in some complex cases which may be successfully treated by means offered by interventional neuroradiology.

Conclusions

According to different authors, parent artery occlusion appears to be safe in the treatment of P2 segment aneurysms, whatever the location of the occlusion – at the level of the neck or just before it. In our case we decided to perform this kind of treatment believing it was the only possible one.

The procedure was carried out in difficult technical conditions, by direct vertebral artery puncture, with use of high-concentrated glue, which made the treatment even more strategically complicated.

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